

HOMING OF PURPLE MARTINS¹

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MANY papers dealing with homing and orientation have been published. Relatively few of these papers pertain to homing ability of passerines during the breeding season. With this in mind I conducted a series of 16 homing experiments on Purple Martins (*Progne subis*) in the summer of 1958 at the University of Michigan Biological Station, Cheboygan County, Michigan. A colony of 60 pairs of martins nested in four houses along the shore of Douglas Lake.

I trapped the martins in nylon snares, made of six-pound-test monofilament fishing line, placed at the entrances to the nests. The loop of the snare surrounded the entrance hole and was held in position by a tack. When the adult entered the nest it passed through the noose which closed around its neck. The weight of the bird kept the noose tight, thus preventing escape. The birds struggled only slightly and sometimes hung motionless until I released them. No birds were injured by the snares; all birds trapped and used in experiments survived throughout the summer. Since the females did most of the nesting tasks they entered the compartments more readily, hence only two males were captured during the summer. Only one member of a pair was used in any one trial. A different bird was used for each trial.

Birds were transported to the point of release by automobile. They were carried in closed cigar boxes, and the periods of confinement ranged from 15 minutes to 23.8 hours.

Each experimental bird was color-marked in such a manner that I could distinguish it from all other martins in the colony. However, these color markings were of little use at a distance. Therefore, I waited until I definitely saw the marked bird return to the nest compartment before I considered it as a return. I refrained from marking the flight feathers with enamel because it might have interfered with flight. The enamel was placed on the crown, rump, breast, back, throat, or crissum. Seven different colors of enamel were used. For more permanent identification a U.S. Fish and Wildlife Service numbered aluminum band was placed on one leg of each bird and a plastic color band on the other.

I wish to express my appreciation to Harrison B. Tordoff for his useful suggestions during this project, to Donald Moline and other Station personnel for aid in dispatching and observing experimental birds, and to Edmund J. Tucker of the Michigan Conservation Department for observations on one bird at the release point. The expenses of this project were met by a National Science Foundation grant.

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EXPERIMENTS

Adult martins were transported to distances ranging from 1.75 miles to 234 miles (air distance). The length of time required for returns varied greatly. In several cases the precise time of return could not be determined. Furthermore, some homing birds probably were in the vicinity of the colony for some time without returning to the nest and therefore passed unnoticed. The experimental martins were usually extremely nervous after returning and hesitated to approach the nest compartment. They closely examined the entrance before they entered.

Weather conditions during these experiments varied greatly. Birds were released during rain storms, cloudy periods, clear sunny days, clear starlit nights, and cloudy nights. Wind velocity varied from two or three mph up to 28 mph. Climatological data for the release points (obtained from the U.S. Weather Bureau or local authorities) appear in Table 1.

I released birds in various directions from the home colony. Birds were liberated north of the Straits of Mackinac, on the Wisconsin side of Lake Michigan, and in the interior of the Lower Peninsula of Michigan.

The first five martins were discharged close to the Biological Station (1.75 to 10 miles) and were apparently presented with no difficulty in homing (see Table 2). This was probably familiar territory to the birds and perhaps much of it had been covered during normal feeding activities. The longer flights probably presented a greater challenge to the birds because of the increased likelihood that they must fly over unfamiliar territory, especially from release points north and west of home.

Number 6.—Female released in Grand Rapids, Michigan, at 12:00 noon, June 28. There was a strong wind (west-southwest 15 mph). She was not seen at the Station for 25.5 hours. Possibly the bird returned sooner but was not noticed or did not enter the house.

Number 7.—Male released at 8:10 p.m., June 28 at Charlevoix, Michigan. I released the bird near the shore of Lake Michigan and within the boundaries of another martin colony. He ignored the other martins and apparently they did not respond to his presence. The male performed the usual circling and gaining of altitude. The circles increased in diameter as he gained altitude. Never did the circle extend over the lake. After a few minutes I lost sight of the bird. I was not present at the Station to record the exact time of return, but he was present at the nest at 7:00 p.m., June 29.

Number 8.—This female was released at Petoskey, Michigan, at 7:45 p.m., June 28. She was not observed at the Station that evening but was seen at 7:00 a.m. the following day. She probably returned the previous evening or night. Upon release, near Little Traverse Bay, she gained altitude, circled once and headed directly toward the Station.

TABLE I
WEATHER DATA AT PURPLE MARTIN RELEASE POINTS IN 1958

Release Point	Bird No.	Date	Temp. (°F.)		Precipitation (inches)	Wind		Sunshine (min.)	Sky Cover (per cent)	Visibility (miles)	Remarks
			High	Low		Dir.	Speed (mph)				
Pellston	1	June 25	59*	47*	trace	SW	18-20*	—	100	—	—
Reese's Bog	2	June 25	59*	47*	trace	SW	18-20*	—	100	—	—
Riggsville	3	June 25	59*	47*	trace	SW	18-20*	—	100	—	—
Cheboygan	4 & 5	June 27	74	48	0	WNW	11-15	60	0	15	clear
Grand Rapids	6	June 28	81	59	0	WSW	12-15	—	—	15	partly cloudy
Charlevoix	7	June 28	77	60	0	SSW	4-7	—	—	20	clear
Petoskey	8	June 28	75	52	0	SSW	4-7	—	—	20	clear
Escanaba	9	July 1	73		.77	S	12-18	0	100	0-2	fog
Lena, Wis.	10	July 1	85	71	trace	WSW	20-28	—	—	10	partly cloudy
Ann Arbor	11	July 7	81	67	0	NW	12	0	100	—	cloudy, wind variable
Flint	12	July 7	79	64	.28	SW	2-5	—	100	15	fog earlier, cloudy, wind variable
Ann Arbor	13	July 8	78	63	0	NW	14	—	80	—	cloudy
Sleeper Lake	14	July 13	79	66	0	NW	8	—	30	7	—
Michelson	15	July 18	68	49	trace	W	0-2	—	—	—	clear by night
Crayling	16	July 18	66	46	trace	W	0-3	—	—	—	storm front to the north (20 miles)

* Estimates by the observer.

TABLE 2

DATA PERTAINING TO 16 HOMING FLIGHTS BY PURPLE MARTINS IN 1958

Bird No.	Sex	Nest Contents	Release Point	Mileage	Direction	Released		Returned		Maximum Time to Return
						Date	Time	Date	Time	
1	♀	eggs	Pellston	6	W	June 25	12:32 p.m.	June 25	1:20 p.m.	.8 hr.
2	♀	eggs	Reese's Bog	1.75	S	June 25	3:15 p.m.	June 25	3:37 p.m.	.3 hr.
3	♀	eggs	Riggsville	4	E	June 25	4:20 p.m.	June 25	4:31 p.m.	.2 hr.
4	♀	eggs	Cheboygan	9	ENE	June 27	1:21 p.m.	June 27	2:05 p.m.	.7 hr.
5	♀	eggs	Cheboygan	10	ENE	June 27	1:30 p.m.	June 27	3:50 p.m.*	1.5 hrs.
6	♀	eggs & young	Grand Rapids	202	SSW	June 28	12:00 noon	June 29	1:30 p.m.*	25.5 hrs.
7	♂	young	Charlevoix	32.5	WSW	June 28	8:10 p.m.	June 29	7:00 a.m.*	22.8 hrs.
8	♀	young	Petoskey	19.5	WSW	June 28	7:45 p.m.	June 29	7:00 a.m.*	23.3 hrs.
9	♀	young	Escanaba	117	NNW	July 1	1:00 p.m.	July 2	12:00 noon	23.0 hrs.
10	♀	young	Lena, Wisc.	169	WSW	July 1	4:00 p.m.	July 2	10:30 a.m.	18.5 hrs.
11	♀	young	Ann Arbor	234	SSE	July 7	10:40 p.m.	July 8	7:15 a.m.*	8.6 hrs.
12	♀	young	Flint	185	SSE	July 7	6:45 p.m.	July 8	7:15 a.m.*	12.5 hrs.
13	♀	young	Ann Arbor	234	SSE	July 8	6:50 a.m.	July 8	5:30 p.m.*	10.7 hrs.
14	♀	young	Sleeper Lake	77	NNW	July 11	9:00 p.m.	July 13*	—	—
15	♀	young	Michelson	83	S	July 18	10:30 p.m.	July 21	6:30 a.m.*	—
16	♂	young	Grayling	62	S	July 18	8:05 p.m.	July 21*	—	—

* Perhaps returned earlier but not recorded.

Number 9.—This female was released at Escanaba in the Upper Peninsula of Michigan at 1:00 p.m., July 1. She remained in the area until 3:35 p. m. (observed by E. J. Tucker). This delay in departure was probably brought about by the locality being blanketed with fog. She had definitely returned and entered the house by noon on July 2. However, I thought I saw her at 7:15 p.m. on July 1.

Number 10.—Female released in Lena, Wisconsin, at 4:00 p.m. on July 1. She performed the usual circling behavior upon release and gained altitude. Perhaps this bird encountered fog when she neared Lake Michigan. She returned to the nest at 10:30 a.m., July 2. I believe that she had just returned from the homing flight since she seemed fatigued and unsteady. She landed on the perch outside the nest, wobbled back and forth, and finally fell. She caught herself on another perch located about 10 inches below. There she perched and continued to wobble about. At 12:30 p.m. she acted more stable but still did not seem completely normal. Later in the afternoon she appeared much stronger. It would be interesting to know the direction taken by this bird upon reaching the Wisconsin shore of Lake Michigan. Did she follow the shore line or did she fly directly across?

Number 11.—Female released in Ann Arbor at 10:40 p.m., July 7. She had returned to the Station and was feeding young at 7:15 a.m., July 8. From her behavior, I am certain that she had been in the area for some time. As mentioned earlier, the birds always seemed suspicious after returning from a homing flight. When I first saw this bird she did not hesitate in the least before entering the nest compartment.

She made the flight of 234 miles in no more than 8.6 hours. This is an average speed of 27.2 mph. To have established this average the martin must have exceeded this speed considerably at times, especially if she wandered in search of landmarks. However, this rate of return seems to exclude much wandering. Meinertzhagen (1921:230) had comparable results with Barn Swallows (*Hirundo rustica*). He conducted experiments in East Africa, and one bird averaged 37.75 mph, and another 34 mph. His record of an earlier flight of a swallow from Paris to Roubaix at a speed of 106 mph is open to doubt, as he pointed out. Rüppell (in Matthews, 1955:41) also conducted experiments with Barn Swallows. His birds averaged only 9 to 10 mph in homing. There are records of non-passerine species homing at rates of 8 to 37 mph.

Most interesting is the fact that Number 11 made a nocturnal homing flight. Supposedly, Purple Martins are diurnal migrants and therefore, as discussed by Lakhovsky (in Mattingley, 1946:513), should not be capable of nocturnal orientation. The fact that martins may occasionally migrate by night is suggested by Trautman's statement (1940:307) referring to a flock of 150 birds that arrived in his area in the early afternoon and left at dark. He referred to

this as "a rather curious performance for these supposedly day migrants." Many observers, including the Andersons (1946:140-141), Cater (1944:15-18), Higman (1944:43-44), and Woodbury (1946:42), have reported large flocks of martins preparing to roost for the night. Estimates of up to 25,000 martins have been given for such roosts. None of these observers mentions checking on these flocks at night to see if the birds were still present. Smith (1908:41-43) watched a diurnal migratory flight of more than 10,000 Purple Martins at Macatawa, Michigan.

Since the sky was entirely overcast (a second cloud layer being above the first), it seems unlikely that celestial navigation was possible.

Number 12.—Female released in Flint, Michigan, at 6:45 p.m., July 7. Upon release she flew south one block and then headed northwest. She had returned to the Station by 7:15 a.m., July 8. This bird probably returned earlier because she had lost all suspicion of the nest site. Part of this flight must have been performed at night.

Number 13.—Female released in Ann Arbor, Michigan, at 6:50 a.m., July 8. This bird had been captive in a darkened container for 23.8 hours. She returned to the Biological Station sometime during the afternoon of July 8. I was prevented from checking on the return until 5:30 p.m., and she was present at that time. Apparently she made this return flight in a time comparable to bird Number 11.

Number 14.—Female released at Sleeper Lake, Luce County, in the Upper Peninsula of Michigan at 9:00 p.m., July 11. She circled clockwise and then counter clockwise while gaining altitude and then headed southeast. I did not see her at the Station until the afternoon of July 13, although I made periodical checks during each day of her absence.

Number 15.—Female released at Michelson, Roscommon County, Michigan, at 10:30 p.m. on July 18. At the release point the sky was clear of clouds, and there was little wind. A storm center lay between the bird and home at the time of release. She did not return until 6:30 a.m. on July 21.

Number 16.—Male released at Grayling, Michigan, at 8:05 p.m., July 18. He circled high for about ten minutes before I lost sight of him. He was confronted with the same storm center as bird Number 15. I failed to note him at the Station until 6:30 a.m., July 21.

DISCUSSION

To my knowledge this was the first time Purple Martins were used in homing experiments. Other members of the Hirundinidac have been used. These include the Bank Swallow (*Riparia riparia*), Rough-winged Swallow (*Stelgidopteryx ruficollis*), Barn Swallow, and the House Martin (*Delichon urbica*). These species have homed in trials ranging from four miles to the amazing

distance of 1150 miles (see Table 3). The percentage of returns has varied greatly. Rarely did investigators that used more than four birds find a return rate higher than 50 per cent. It is therefore of interest to note that all 16, or 100 per cent, of my Purple Martins returned from the point of release.

TABLE 3
HOMING DATA PERTAINING TO THE HIRUNDINIDAE

Species	Trials	Returns	Per Cent Returned	Distances (miles)	Sources
Bank Swallow	35	13	37	4-142	Loos (1907), Matthews (1955)
Rough-winged Swallow	3	3	100	4-33	Gillespie (1934)
Barn Swallow	198	92	47	4-1150	Dupond (1935), Keller (1926), Lack (1938), Lockley (1942), Loos (1907), Rüppell (1934, '35, '36, '38), Wodzicki (1934, '38, '39), Wojtusiak (1937)
Purple Martin	16	16	100	1.75-234	Southern (present study)
House Martin	35	12	34	7-450	Matthews (1955), Rüppell (<i>op. cit.</i>), Wodzicki (1934)

SUMMARY

During the summer of 1958, 16 Purple Martins were used in a series of homing experiments at the University of Michigan Biological Station.

The birds were released at distances ranging from 1.75 miles to 234 miles. The rate of return varied greatly. The most rapid return was a nocturnal flight of 234 miles in 8.58 hours.

One hundred per cent of the martins returned from the homing flights. This material has been compared with the available homing data pertaining to the Hirundinidae.

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